

In re Patent Application of:

**WILSON ET AL**

Serial No. **10/647,558**

Filed: **08/25/2003**

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## REMARKS

### Specification

The objection to the title is believed to have been overcome by the new descriptive title, which is now believed to be clearly indicative of the invention to which the claims are directed. However, if the amended title is not considered satisfactory, an indication of what title would be acceptable would be appreciated in a future Office Action.

In the specification, the paragraphs [0009], [0016] - [0018] have been amended.

Paragraph [0009] in the background section has been amended to replace the word "or" with the word "and" to correct an error, as follows:

*"...a compensated voltage stored in memory related to the outside temperature about the package and related to the power of the laser diode".*

Paragraphs [0016]-[0018] have been amended to more clearly define the invention and to provide a direct antecedent basis to amended independent claim 1, as discussed hereinbelow.

### Claims

Claims 1-11 are pending in this application.

Claims 1-11 have been rejected.

Claim 8 has been objected to.

Claims 1, 2, 4, 5, 8, 10, and 11 are currently amended.

Claims 1-11 remain in this application.

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### ***Claim Objections***

**Claim 8** has been objected to under 35 U.S.C. 112, second paragraph, as being indefinite because the limitation "the photodiode" recited therein allegedly lacking proper antecedent basis.

Claim 8 has been amended to use the limitation "the photodetector" in place of the original limitation "the photodiode". The new limitation "the photodetector" has antecedent basis in claim 1 (third clause), on which claim 8 depends. Withdrawal of the objection is respectfully requested.

### ***Claim Rejections - 35 USC § 103***

Claims 1-11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Broutin at al. (U.S. Patent 6,839,364) in view of Suni at al. (U.S. Patent 6,233,045).

Applicants have amended independent claims 1, 10 and 11 in an effort to overcome the rejection so that these claims, and claims 2-9, dependent on amended claim 1, are believed to be patentable over the cited prior art.

**Amendments to independent Claim 1 to overcome rejection under 35 U.S.C. 103(a).**

Independent Claim 1, which defines a transmitter for providing a wavelength stabilized output signal, has been amended to specify that the transmitter employs two temperature-sensing elements:

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the photodetector disposed within the package that provides a signal that is related to the temperature of the light source when the photodetector is in the forward bias mode, and

the temperature sensor disposed outside of the package for providing a signal indicating an ambient temperature about the package; and,

that the transmitter further employs the feedback circuit that

(i) utilizing the indication of the output power from the photodetector and the signal indicating the ambient temperature from the temperature sensor to form a power control signal to adjust the output power of the light source, and

(i) utilizing the signal related to the temperature of the light source from the photodetector and the signal indicating the ambient temperature from the temperature sensor to form the temperature control signal for adjusting the temperature of the light source to adjust the wavelength thereof.

Support for these added limitations can be found in Figure 1, and paragraphs [0023], [0025]-[0027] of the current application as published.

Broutin et al and Suni et al do not teach, disclose or suggest these added limitations.

**Broutin et al** ('364) disclose a method of operating a distributed Bragg reflector tunable laser device using nested control loops 52, 54, 56 for controlling the laser tuning current, wavelength/temperature and power, respectively.

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With respect to the power control loop 56, Broutin et al describe that (col.5, lines 11-13) *"The power control loop 56 adjusts the gain current  $I_{gain}$  in response to the signals 30 from the backface monitor 34."* Nowhere in their specification do Broutin et al disclose a power control loop *"utilizing ... the signal indicating the ambient temperature from the temperature sensor to form a power control signal"*, as specified in amended claim 1.

With respect to the control loop (feedback circuit) recited in the Office Action that includes elements 38,14, this control loop, which utilizes the backface monitor signal 30 to adjust the tuning current, is described by Broutin et al as being for use during the laser start-up, to collect slope data required for determining the laser operating point, to be disengaged after the start-up phase is completed (see col.4, line 38- col.5, line 11). Nowhere in their specification do Broutin et al describe that this loop/feedback circuit utilizes *"the signal indicating the ambient temperature from the temperature sensor"*.

With respect to the wavelength/temperature control loop 54, Broutin et al in '364 describe that this loop includes a wavelength discriminator 32 that *"generates a signal 26 representative of the wavelength of the output light"* (col.4, lines 9-10), and a TEC 22. This loop, as disclosed by '364, **does not** utilize two temperature-related signals, as specified in amended claim 1, to form the temperature control signal for controlling the TEC 22, but rather uses the signal 26 from the wavelength discriminator 32 to generate the TEC control signal 36, so as to adjust the laser temperature and thereby adjust its wavelength.

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Suni et al disclose a self-mixing laser sensor apparatus for remotely measuring speed, vibrations, range, and length. The apparatus is based on a semiconductor laser, and Suni et al describe that the wavelength of the laser can be kept within a suitable tolerance band, by maintaining the laser temperature to a specified set point, using a temperature control including a TEC and a temperature sensor for sensing the laser temperature. Suni et al further describe that "the standard photodiode generally included on commercial laser substrates" can be used as the temperature sensor to facilitate laser power. "By alternately monitoring the forward bias voltage drop across the photodiode, and the reverse bias current through the photodiode, both the laser diode temperature and optical power may be monitored using the same device in intimate thermal contact with the laser diode" (col.17, lines 11-21).

Thus, the monitoring photodiode of Suni et al, the temperature sensor 20 "thermally coupled to the DBR tuning and gain sections" of Broutin et al, and the photodetector in the forward bias mode recited in claim 1 of the present application all perform a similar function of providing a signal related to the laser temperature.

However, Suni et al and Broutin et al do not disclose or suggest using an additional temperature sensor "disposed outside of the package for providing a signal indicating an ambient temperature about the package", as specified in amended claim 1. This second temperature sensor enables any small difference in temperature of the detector and the laser diode due to temperature changes outside the laser package to be compensated, thereby enabling more accurate wavelength control, than that provided by

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the single temperature sensors in the architectures of Broutin et al and Suni et al.

Moreover, neither Broutin et al nor Suni et al provide any motivation of using such an additional temperature sensor.

Summarizing, the present invention as claimed in amended claim 1 defines novel and inventive features as recited hereinabove, which are not disclosed or suggested in the cited prior art.

Consequently, a combination of the cited prior art does not yield the claimed invention, which therefore could not be considered obvious to a person skilled in the art at the time the invention was made.

Applicants therefore believe that the transmitter of the instant invention, as claimed in amended claim 1, and claims 2-9 dependent thereon, is patentable over the prior art.

#### **Amendments to independent claims 10 and 11**

Independent claims 10 and 11 have been amended to include the limitation "a temperature sensor disposed outside of the package for providing a signal indicating an ambient temperature about the package". Similar to amended claim 1, amended independent claims 10 and 11 now define two temperature sensing elements. Neither Broutin et al nor Suni et al disclose or suggest this added limitation, as discussed hereinabove.

Consequently, the combination of the cited prior art does not yield the invention as claimed in amended independent claims 10 and

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11, which therefore could not be considered obvious to a person skilled in the art at the time the invention was made.

Consequently, amended independent claims 10 and 11 are now believed to be patentable.

#### **Other claim amendments**

In addition to the foregoing amendments to overcome the rejection under 35 U.S.C. 103(a), claims 1, 2, 4, 5, 8, 10, and 11 have been further amended to more clearly define the invention, and to correspond to amended features of claim 1.

#### **Amended Claim 1**

The "switching means" clause of amended claim 1 now specifies that the signal provided by the photodetector in the forward bias is "*related to the temperature and output power of the light source*". This new limitation is supported by paragraphs [0008], [0009], [0025] of the original specification.

The last clause of claim 1, defining a look-up table, has been amended as follows: (a) to define "a memory circuit operationally coupled to the feedback circuit and the temperature sensor", so as to clearly specify where the look-up table is stored, and (b) to more clearly specify that the stored values correspond to "*control voltages for adjusting the temperature control signal at a plurality of different ambient temperatures about the package*". Support for the amendments can be found in Figure 1, and paragraphs [0026] and [0027] of the original specification.

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Applicants would like to note that the new amended feature (b) as recited hereinabove clearly differentiate the look-up table of the present invention from the look-up table 50 taught by Broutin et al in '364. Indeed, '364 teaches that "the look-up table 50 contains data representative of tuning currents at which DBR mode-hopping would occur" (col.3, lines 15-17). Nowhere in '364 do Broutin et al teach that the look-up table 50 stores values that correspond to control voltages "for adjusting the feedback temperature control signal at a plurality of different ambient temperatures about the package". This feature of the present invention is not disclosed or suggested by either of the cited prior art references and the claimed invention cannot be considered obvious to one skilled in the art at the time when the invention was made.

**Claim 2** has been amended by replacing the limitation "a plurality of different ambient temperatures" by the limitation "the plurality of different ambient temperatures", which is now defined in amended claim 1.

**Claims 4 and 5** have amended to replace the wordings "TEC control signal" with the wording "temperature control signal" as defined in amended claim 1.

**Claim 4** has been further amended to clearly specify a function of a TEC defined in the claim as being for "varying the temperature and thereby the wavelength of the light source", and to clearly specify that the temperature control signal is based on, *inter alia*, "the ambient temperature about the package" as defined in amended claim 1.



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**Claim 8** has been amended to include a limitation "wherein the stored values account for the output power of the light source received by the photodetector during the forward biased mode of operation". Support for this limitation can be found in the original specification, e.g. paragraphs [0009], [0025] and [0027].

**Independent Claim 10** now includes the limitation "coupled to the temperature sensor " as referred to the memory array; support for this limitation can be found in the original specification, e.g. Figure 1.

**Independent Claim 11** has been amended to clearly specify which components are being housed within the hermetic package, and that the method steps defined by the amended claim 11 are performed in operation.

**Claims 10 and 11** have been further amended to clearly specify that the method steps are performed while the transmitter is in operation, and that the TEC control values / test values are determined "while the photodetector is operating in the forward bias mode". Support for this limitations can be found in the original description, see e.g. paragraph [0027].

The rejection regarding claims 2-8, 10 and 11 alleges that "*the manner in which calibration (the lookup table values) is carried out is notoriously well known. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use such method steps in the apparatus of Broutin at al. in view of Suni at al. to obtain correct values for a desired output*".

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Applicants respectfully traverse this assertion, and submit that, to the best of the Applicants' knowledge, the transmitter calibration, as defined by the amended claims 2-8, 10 and 11, has features that are novel and have not been previously disclosed in the art.

In particular, Applicants believe that selecting and storing test values corresponding to control voltages for maintaining a constant wavelength, while operating the photodetector within the transmitter package in forward bias mode, thereby enabling calibrating out the effect of light coupled into the photodetector, has not been disclosed heretofore.

Applicants therefore respectfully request that, if the current amendments to the claims are not considered to overcome the assertion of the calibration as being "well known", concrete evidence in the record be provided in support of the assertion.

In view of the foregoing amendments to the title, specification and claims, which, for the reasons discussed above, are believed to obviate each of the objections and grounds of rejection advanced in the outstanding Office Action, and thereby place the claims in condition for allowance, favorable reconsideration of this application and a notice of allowance of Claims 1-11 are respectfully requested.

Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

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Please charge any shortage in fees due in connection with the filing of this paper, including the One-Month Extension of Time fee of \$120.00, to Deposit Account No. **50-1465** and please credit any excess fees to such deposit account.

Respectfully submitted,



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CHARLES E. WANDS  
Reg. No. 25,649

**Customer No.: 27975**

Telephone: (321) 725-4760